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TARANINA, MARINA Y	
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Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	**Application No.** 10/605,107	**Applicant(s)** HALLEMEIER ET AL.	
	Examiner Marina Taranina	**Art Unit** 2613	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 September 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-42* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-42* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *09 September 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date *20 Nov 2003 and 24 Nov 2003*.

4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-3, 8, 14 and 19 are rejected under 35 U.S.C. 102(b) as being anticipated by Fukuchi (US 5 745 613).

(1) With respect to claim 1, Fukuchi discloses an optical transmitter for an optical fiber transmission system, the optical transmitter comprising:

an optical source (1 in fig. 1) that generates an optical signal having a wavelength at an output (col. 3 lines 63-65);

an optical intensity modulator (3 in fig. 1) having an optical input that is coupled to the output of the optical source (1 in fig. 1), an electrical input that receives an electrical modulation signal (data signal output of 2 in fig. 1, col. 3 line 65- col. 4 line 1), and an output (output of 3 in fig. 1), the optical intensity modulator modulating the optical signal with the electrical modulation signal (data signal) to generate a modulated optical signal at the output (col. 3 line 65- col. 4 line 1), wherein at least one parameter (.alpha.-parameter) of intensity modulator is chosen to suppress (col. 4 lines 23-30) at least one of phase and sideband information in the modulated optical signal (col. 5 lines 18-22, col. 4 lines 28-36);

and an optical fiber (5 in fig. 1) that is coupled to the output of the optical intensity modulator (2-5 and 3-5 in fig. 17), wherein the suppression of the at least one of the phase (col. 4 lines 23-36) and the sideband information in the modulated optical signal increases an effective modal bandwidth of the optical fiber (by waveform compression, col. 4 line 63 - col. 5 line 5, col. 5 line 39-44).

(2) With respect to claim 2, Fukuchi discloses the optical transmitter of claim 1 wherein the optical source comprises a laser that generates the optical signal (col. 5 lines 51-52).

(3) With respect to claim 3, Fukuchi discloses the optical transmitter of claim 1 wherein the optical signal generated by the optical source comprises a continuous wave optical signal (col. 5 lines 51-52).

(4) With respect to claim 8, Fukuchi discloses the optical transmitter of claim 1 further comprising a second optical source (1' in fig. 1) that generates a second optical signal having a second wavelength at an output (col. 5 lines 49-50);

a second optical intensity modulator (3' in fig. 1) having an optical input that is coupled to the output of the second optical source (1' in fig. 1), an electrical input that receives a second electrical modulation signal (data signal output of 2' in fig. 1, col. 5 lines 58-61), and an output (output of 3' in fig. 1), the second optical intensity modulator modulating the second optical signal with the second electrical modulation signal (data signal output of 2' in fig. 1) to generate a second modulated optical signal at the output (col. 5 lines 58-61), wherein at least one parameter of the second optical intensity

modulator is chosen to suppress at least one of phase and sideband information in the second modulated optical signal (col. 4 lines 8-14, col. 5 lines 39-44).

(5) With respect to claim 14, Fukuchi discloses the optical transmitter of claim 1 wherein the optical fiber (5 in fig. 1) comprises a single-mode optical fiber (col. 4 line 45).

(6) With respect to claim 19, Fukuchi discloses the optical transmitter of claim 1 further comprising a bias voltage power supply (34 in fig. 6) having an output that is coupled to a bias input (31 in fig. 6) of the optical intensity modulator (3 in fig. 6), the bias voltage power supply generating a voltage that suppresses at least one of phase and sideband information in the modulated optical signal (by applying voltage to control the sign of the .alpha.–parameter, col. 8 lines 12-35).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 5, 6 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fukuchi (US 5 745 613) in view of Suzuki (US 5 394 260).

(1) With respect to claim 5, Fukuchi discloses all the subject matter as recited in claim 1, but fails to teach the optical source and the optical intensity modulator comprising an electro-absorption modulated laser.

However, Suzuki teaches an electro-absorption modulated laser comprised of an optical source (1 in fig. 4) and an optical intensity modulator (2 in fig. 4) (col. 9 lines 46-56).

It is desirable to use integrated components in order to reduce the optical coupling loss.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to employ integrated laser modulator as taught by Suzuki into the system of Fukuchi in order to reduce the optical coupling loss.

(2) With respect to claim 6, Fukuchi discloses all the subject matter as recited in claim 1, but fails to teach an optical source and an optical intensity modulator comprising an integrated laser modulator.

However, Suzuki teaches integrated laser modulator comprised of an optical source (1 in fig. 4) and an optical intensity modulator (2 in fig. 4) (col. 9 lines 46-56).

It is desirable to use integrated components in order to reduce the optical coupling loss.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to employ integrated laser modulator as taught by Suzuki into the system of Fukuchi in order to reduce the optical coupling loss.

(3) With respect to claim 11, Fukuchi discloses all the subject matter as recited in claim 1, but fails to teach that at least one parameter of the optical intensity modulator comprises an extinction ratio of the optical intensity modulator.

However, Suzuki teaches the system wherein a parameter of the optical intensity modulator comprises an extinction ratio of the optical intensity modulator (col. 5 line 66 – col. 6 line 4).

It is beneficial to control output of an optical intensity modulator in order to minimize deterioration of the waveform output of the modulator.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use an extinction ratio as a parameter of an optical intensity modulator as taught by Suzuki into the system of Fukuchi in order to minimize deterioration of the waveform output of the modulator, and therefore, improve overall transmission characteristics.

5. Claims 4, 7, 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fukuchi (US 5 745 613).

(1) With respect to claim 4, Fukuchi discloses the optical transmitter of claim 1, but fails to teach that the optical signal generated by the optical source comprises a phase and amplitude locked optical pulsed signal.

However, the examiner takes official notice of the fact that it is well known in the art to generate optical signals by phase and amplitude locked pulsed optical sources (lasers).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify optical source of Fukuchi by specifically incorporating a phase and amplitude locked pulsed optical source for the purpose of producing ultra-short light pulses.

(2) With respect to claim 7, Fukuchi discloses all the subject matter of Claim 1, and further teaches a plurality of optical sources (1-1" in fig. 1) that generate a plurality of optical signals (output of 1, 1', 1" in fig. 1), each of the plurality of optical signals having a different wavelength (col. 5 lines 47-50).

Fukuchi does not teach a single optical source that generates a plurality of optical signals.

However, it would be beneficial to use a single optical source because it simplifies the system configuration and is more cost-efficient.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to employ a single optical source to generate a plurality of optical signals in order to realize a cost-efficient system and simplify the system configuration.

(3) With respect to claim 9, Fukuchi discloses the optical transmitter of claim 1, but fails to teach that at least one parameter of the optical intensity modulator comprises a bandwidth of the optical intensity modulator.

However, the examiner takes official notice of the fact that it is well known in the art to control parameters of an optical intensity modulator in order to achieve desired output characteristics.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a bandwidth of the optical intensity modulator as a control parameter.

(4) With respect to claim 10, Fukuchi discloses the optical transmitter of claim 1, but fails to teach that at least one parameter of the optical intensity modulator comprises an absorption spectrum of the optical intensity modulator.

However, the examiner takes official notice of the fact that it is well known in the art to control an absorption spectrum of a material in order to identify chemical elements present in the material.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use an absorption spectrum of the optical intensity modulator as a control parameter in order to optimize output characteristics of the modulator by choosing its material or chemical composition.

6. Claims 20, 23, 24, 27, 29 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cunningham (US 6 064 786) in view of Fukuchi (US 5 745 613).

(1) With respect to claim 20, Cunningham discloses a multi-mode optical transmission system comprising:

an optical source (1 in fig. 9) that generates an optical signal having a wavelength (1300nm) at an output (col. 7 lines 8-9);

a modulator (4 in fig. 9, col. 7 line 11);

a spatial mode filter (5 in fig. 9) that is coupled to an output of the single-mode optical fiber (2 in fig. 9) (col. 7 line 12-13);

and a multi-mode optical fiber (6 in fig. 9) having an input that is coupled to an output of the spatial mode filter (5 in fig. 9), wherein the resulting output optical signal increases an effective modal bandwidth of the multi-mode optical fiber (abstract, lines 1-2).

Cunningham does not teach an optical intensity modulator having an optical input that is coupled to the output of the optical source, an electrical input that receives an electrical modulation signal, and an output that is coupled to an input of a single-mode optical fiber, the optical intensity modulator modulating the optical signal with the electrical modulation signal to generate a modulated optical signal at the output, wherein at least one parameter of the optical intensity modulator is chosen to suppress at least one of phase and sideband information in the modulated optical signal.

However, Fukuchi teaches an optical intensity modulator (3 in fig. 1) having an optical input that is coupled to the output of the optical source (1 in fig. 1), an electrical input that receives an electrical modulation signal (data signal output of 2 in fig. 1, col. 3 line 65- col. 4 line 1), and an output (output of 3 in fig. 1), the optical intensity modulator modulating the optical signal with the electrical modulation signal (data signal) to generate a modulated optical signal at the output (col. 3 line 65- col. 4 line 1), wherein at least one parameter (.alpha.-parameter) of intensity modulator is chosen to suppress at least one of phase (chirp) and sideband information in the modulated optical signal (col. 5 lines 18-22);

and an optical fiber (5 in fig. 1) that is coupled to the output of the optical intensity modulator (2-5 and 3-5 in fig. 17), wherein the suppression of the at least one of the phase (chirp) and the sideband information in the modulated optical signal increases an effective modal bandwidth of the optical fiber (resulting in increase in transmission distance – col. 5 line 39-44).

It is desirable to use external modulation techniques (i.e., a system for modulating a light beam of a constant intensity or power emitted from a laser with an optical intensity modulator). This is primarily for the reason that the external modulation system is less susceptible to chirping (than direct laser modulation), and therefore, allows to improve transmission characteristics.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the system of Cunningham by using an optical intensity modulator as taught by Fukuchi as to provide the system that is less susceptible to chirping, which allows to improve transmission characteristics.

(2) With respect to claim 23, Cunningham discloses the transmission system of claim 20, but fails to teach a WDM optical source that generates a plurality of optical signals, each of the plurality of optical signals having a different wavelength.

However, Fukuchi teaches a plurality of optical sources (1-1" in fig. 1) that generate a plurality of optical signals (output of 1, 1', 1" in fig. 1), each of the plurality of optical signals having a different wavelength (col. 5 lines 47-50).

Fukuchi does not teach a single optical source that generates a plurality of optical signals.

However, it would be beneficial to use a single optical source because it simplifies the system configuration and is more cost-efficient.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to employ a single optical source to generate a plurality of optical signals in order to realize a cost-efficient system and simplify the system configuration.

Furthermore, it is desirable to employ a system operating based on wavelength division multiplexing technique in order to increase transmission capacity on the fiber.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the system of Cunningham by employing WDM system as to increase transmission capacity.

(3) With respect to claim 24, Cunningham discloses the transmission system of claim 20, but fails to teach a second optical source that generates a second optical signal having a second wavelength at an output; a second optical intensity modulator having an optical input that is coupled to the output of the second optical source, an electrical input that receives a second electrical modulation signal, and an output, the second optical intensity modulator modulating the second optical signal with the second electrical modulation signal to generate a second modulated optical signal at the output, wherein at least one parameter of the second optical intensity modulator is chosen to suppress at least one of phase and sideband information in the second modulated optical signal.

However, Fukuchi teaches the optical transmitter comprising a second optical source (1' in fig. 1) that generates a second optical signal having a second wavelength at an output (col. 5 lines 49-50);

a second optical intensity modulator (3' in fig. 1) having an optical input that is coupled to the output of the second optical source (1' in fig. 1), an electrical input that receives a second electrical modulation signal (data signal output of 2' in fig. 1, col. 5 lines 58-61), and an output (output of 3' in fig. 1), the second optical intensity modulator modulating the second optical signal with the second electrical modulation signal (data signal output of 2' in fig. 1) to generate a second modulated optical signal at the output (col. 5 lines 58-61), wherein at least one parameter of the second optical intensity modulator is chosen to suppress at least one of phase and sideband information in the second modulated optical signal (col. 4 lines 8-14, col. 5 lines 39-44).

It is desirable to employ WDM system in order to increase transmission capacity on the fiber.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the system of Cunningham by employing WDM system as taught by Fukuchi as to increase transmission capacity.

(4) With respect to claim 27, Cunningham discloses the transmission system of claim 20 wherein the spatial mode filter (5 in fig. 9, 10, col. 7 lines 16-20) increases the effective modal bandwidth (operational bandwidth) of the multi-mode optical fiber (col. 8 lines 34-37).

(5) With respect to claim 29, Cunningham discloses the transmission system of claim 20 further comprising a receiver (7 in fig. 9) having an input that is coupled to an output of the multi-mode optical fiber (6 in fig. 9), the receiver receiving optical signals propagating through the multi-mode optical fiber (col. 7 lines 13-14).

(6) With respect to claim 31, Cunningham and Fukuchi disclose the optical transmission system of claim 20, but fail to teach that at least one parameter of the optical intensity modulator comprises a bandwidth of the optical intensity modulator.

However, the examiner takes official notice of the fact that it is well known in the art to control parameters of an optical intensity modulator in order to achieve desired output characteristics.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a bandwidth of the optical intensity modulator as a control parameter.

(7) With respect to claim 32, Cunningham and Fukuchi disclose the optical transmission system of claim 20, but fail to teach that at least one parameter of the optical intensity modulator comprises an absorption spectrum of the optical intensity modulator.

However, the examiner takes official notice of the fact that it is well known in the art to control an absorption spectrum of a material in order to identify chemical elements present in the material.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use an absorption spectrum of the optical intensity

modulator as a control parameter in order to optimize output characteristics of the modulator by choosing its material or chemical composition.

7. Claims 15, 16, 35, 36-38 and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fukuchi (US 5 745 613) in view of Cunningham (US 6 064 786).

(1) With respect to claim 15, Fukuchi discloses all the subject matter as recited in Claim 1 and 14, but fails to teach a spatial mode filter having an input that is coupled to an output of the single-mode optical fiber and an output that is coupled to an input of a multi-mode optical fiber.

However, Cunningham teaches a spatial mode filter (5 in fig. 9, 10, col. 7 lines 16-20) having an input that is coupled to an output of the single-mode optical fiber (2 in fig. 9, col. 7 line 12) and an output that is coupled to an input of a multi-mode optical fiber (6 in fig. 5, col. 7 line 13).

It is beneficial to employ spatial mode filtering before propagating optical signal through the multi-mode optical fiber as it allows to reduce modal dispersion of the multi-mode optical fiber, which leads to increase in the transmission bandwidth.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to employ spatial mode filtering as taught by Cunningham into system of Fukuchi as to reduce modal dispersion of the multi-mode optical fiber, and to increase the transmission bandwidth.

(2) With respect to claim 16, Fukuchi discloses all the subject matter as recited in Claim 1, but fails to teach that the optical fiber is a multi-mode optical fiber.

However, Cunningham teaches transmission system employing a multi-mode optical fiber (col. 8 lines 39-44).

It is desirable to utilize multi-mode optical fiber capable of transmitting high data rate signals (beyond 1Gbit/s) over short distances (for example, in LANs), because multi-mode fiber has a higher light-gathering capacity than single mode fiber, making splicing less difficult, which is more cost effective.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to include multi-mode optical fiber as taught by Cunningham into system of Fukuchi as to realize a cost-effective system.

(3) With respect to claim 35, Fukuchi discloses a method of generating a modulated optical signal for transmission in an optical fiber, the method comprising: intensity modulating (3 in fig. 1) an optical signal having a wavelength (col. 3 lines 63-65) with an electrical modulation signal (data signal output of 2 in fig. 1, col. 3 line 65-col. 4 line 1) to generate a modulated optical signal, wherein the intensity modulation suppresses at least one of phase (chirp) and sideband information in the modulated optical signal (col. 5 lines 18-22);

and propagating (output of 3 in fig. 1 – input of 4 in fig. 1 – output of 4 in fig. 1 – input of 5 in fig. 1) the modulated optical signal into a optical fiber (5 in fig. 1, col. 4 lines 3-4), wherein an effective modal bandwidth of the optical fiber is increased by the suppression of the at least one of the phase and the sideband information in the modulated optical signal (resulting in increase in transmission distance – col. 5 line 39-44).

Fukuchi does not teach multi-mode optical fiber.

However, Cunningham teaches the method of increasing operational bandwidth of a multi-mode optical fiber (6 in fig. 9, col. 7 line 13, abstract lines 1-2, col. 8 line 34-37).

It is desirable to utilize multi-mode optical fiber capable of transmitting high data rate signals (beyond 1Gbit/s) over short distances (for example, in LANs), because multi-mode fiber has a higher light-gathering capacity than single mode fiber, making splicing less difficult, which is more cost effective.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to include multi-mode optical fiber as taught by Cunningham into system of Fukuchi as to realize a cost-effective system.

(4) With respect to claim 36, Fukuchi discloses all the subject matter of claim 35, but fails to teach spatial mode filtering the modulated optical signal before propagating the modulated optical signal through the multi-mode optical fiber.

However, Cunningham teaches spatial mode filtering (5 in fig. 9, 10, col. 7 lines 16-20) the modulated optical signal (output of 1 in fig. 9, col. 7 lines 9-11) before propagating the modulated optical signal through the multi-mode optical fiber (6 in fig. 5, col. 7 line 13).

It is beneficial to employ spatial mode filtering before propagating optical signal through the multi-mode optical fiber as it allows to reduce modal dispersion of the multi-mode optical fiber, which leads to increase in the transmission bandwidth.

Therefore, it would have been obvious to one of ordinary skill in the art at the

time the invention was made to employ spatial mode filtering as taught by Cunningham into system of Fukuchi as to reduce modal dispersion of the multi-mode optical fiber, and to increase the transmission bandwidth.

(5) With respect to claim 37, Fukuchi teaches all the subject matter of claim 35, but fails to teach spatial mode filtering the modulated optical signal after propagating the modulated optical signal through the multi-mode optical fiber.

However, Cunningham teaches spatial mode filtering (5 in fig. 9, 10, col. 7 lines 16-20) the modulated optical signal (output of 1 in fig. 9, col. 7 lines 9-11) after propagating the modulated optical signal through the multi-mode optical fiber (2 in fig. 9, col. 8 lines 39-44).

It is beneficial to employ spatial mode filtering after propagating optical signal through the multi-mode optical fiber as it allows to reduce modal dispersion of the multi-mode optical fiber, which leads to increase in the transmission bandwidth.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to employ spatial mode filtering as taught by Cunningham into system of Fukuchi as to reduce modal dispersion of the multi-mode optical fiber, and to increase the transmission bandwidth.

(6) With respect to claim 38, Fukuchi further teaches the method of claim 35 comprising intensity modulating (3' in fig. 1) a second optical signal (1' in fig. 1), having a second wavelength (col. 5 lines 49-50) with a second electrical modulation signal (data signal output of 2' in fig. 1) to generate a second modulated optical signal (data signal output of 3' in fig. 1) and propagating (output of 3' in fig. 1 – input of 4 in fig. 1 –

output of 4 in fig. 1 – input of 5 in fig. 1) the second modulated optical signal into an optical fiber (5 in fig. 1, col. 4 lines 3-4).

(7) With respect to claim 42, Fukuchi discloses an optical transmitter comprising: means for intensity modulating (3 in fig. 1) an optical signal having a wavelength (col. 3 lines 63-65) with an electrical modulation signal data signal output of 2 in fig. 1, col. 3 line 65- col. 4 line 1) to generate a modulated optical signal, wherein the intensity modulation suppresses at least one of phase (chirp) and sideband information in the modulated optical signal (col. 5 lines 18-22);

means for propagating (output of 3 in fig. 1 – input of 4 in fig. 1 – output of 4 in fig. 1 – input of 5 in fig. 1) the modulated optical signal into a optical fiber (5 in fig. 1, col. 4 lines 3-4), wherein an effective modal bandwidth of the optical fiber is increased by the suppression of the at least one of the phase and the sideband information in the modulated optical signal (resulting in increase in transmission distance – col. 5 line 39-44).

Fukuchi does not teach multi-mode optical fiber.

However, Cunningham teaches the method of increasing operational bandwidth of a multi-mode optical fiber (6 in fig. 9, col. 7 line 13, abstract lines 1-2, col. 8 line 34-37).

It is desirable to utilize multi-mode optical fiber capable of transmitting high data rate signals (beyong 1Gbit/s) over short distances (for example, in LANs), because multi-mode fiber has a higher light-gathering capacity than single mode fiber, making splicing less difficult, which is more cost effective.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to include multi-mode optical fiber as taught by Cunningham into system of Fukuchi as to realize a cost-effective system.

8. Claims 21, 22 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cunningham (US 6 064 786) in view of Fukuchi (US 5 745 613) and further in view of Suzuki (US 5 394 260).

(1) With respect to Claim 21, Cunningham and Fukuchi disclose all the subject matter as recited in Claim 20, but fail to teach that the optical source and the optical intensity modulator comprise an electro-absorption modulated laser.

However, Suzuki teaches an electro-absorption modulated laser (fig. 4) comprised of an optical source (1 in fig. 4) and an optical intensity modulator (2 in fig. 4) (col. 9 lines 46-56).

It is desirable to use integrated components in order to reduce the optical coupling loss.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to employ integrated laser modulator as taught by Suzuki into the system of Fukuchi in order to reduce the optical coupling loss.

(2) With respect to Claim 22, Cunningham and Fukuchi disclose all the subject matter as recited in Claim 20, but fail to teach that the optical source and the optical intensity modulator comprise an integrated laser modulator.

However, Suzuki teaches integrated laser modulator (fig. 4) comprised of an optical source (1 in fig. 4) and an optical intensity modulator (2 in fig. 4) (col. 9 lines 46-56).

It is desirable to use integrated components in order to reduce the optical coupling loss.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to employ integrated laser modulator as taught by Suzuki into the system of Fukuchi in order to reduce the optical coupling loss.

(3) With respect to Claim 33, Cunningham and Fukuchi disclose all the subject matter as recited in Claim 20, but fail to teach that at least one parameter of the optical intensity modulator comprises an extinction ratio of the optical intensity modulator.

However, Suzuki teaches the system wherein a parameter of the optical intensity modulator comprises an extinction ratio of the optical intensity modulator (col. 5 line 66 – col. 6 line 4).

It is beneficial to control output of an optical intensity modulator in order to minimize deterioration of the waveform output of the modulator.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use an extinction ratio as a parameter of an optical intensity modulator as taught by Suzuki into the system of Fukuchi in order to minimize deterioration of the waveform output of the modulator, and therefore, improve overall transmission characteristics.

9. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fukuchi (US 5 745 613) in view of Kitajima (US 5 515 196).

With respect to claim 12, Fukuchi discloses the optical transmitter of claim 1, but fails to teach that at least one parameter of the optical intensity modulator comprises an absorption coefficient of the optical intensity modulator.

However, Kitajima teaches the system wherein at least one parameter of the optical intensity modulator comprises an absorption coefficient of the optical intensity modulator (col. 15 lines 53-59).

It is desirable to use an absorption coefficient of the optical intensity modulator as a control parameter because it allows to control the degree of the intensity modulation and because an absorption coefficient corresponds to propagation distance.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use an absorption coefficient of the optical intensity modulator as a control parameter in order to achieve desired output characteristics by changing the degree of the intensity modulation.

10. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fukuchi (US 5 745 613) in view of Chraplyvy (US 5 420 868).

With respect to Claim 13, Fukuchi discloses all the subject matter as recited in claim 1, but fails to teach an optical isolator that substantially eliminates reflected optical signals from propagating into the output of the optical intensity modulator.

However, Chraplyvy teaches an optical isolator (14 in fig. 1) that substantially eliminates reflected optical signals from propagating into the output of the optical intensity modulator (col. 3 lines 40-44).

It is beneficial to use optical isolator because it improves strength of the signal output of a laser due to minimized noise, occurring in the laser in presence of back reflections.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to employ optical isolator as taught by Chraplyvy into the system of Fukuchi as to improve laser signal strength.

11. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fukuchi (US 5 745 613) in view of Tabuchi (JP 409318919).

With respect to Claim 17, Fukuchi discloses all the subject matter as recited in claim 1, but fails to teach that the at least one parameter of the optical intensity modulator is chosen to increase immunity of the effective modal bandwidth of the optical fiber to polarization effects occurring in at least one of the optical source and the optical fiber.

However, Tabuchi teaches the optical intensity modulator (20 in Figure) with polarization control (11 in Figure) to lower dependence on polarization (abstract).

It is beneficial to control polarization because it allows to minimize dispersion on a transmission link.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to include polarization control as taught by Tabuchi into the system of Fukuchi as to minimize dispersion on a transmission link.

12. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fukuchi (US 5 745 613) in view of Ibe (US 2003/0058519)

With respect to Claim 18, Fukuchi discloses all the subject matter as recited in claim 1, but fails to teach that at least one parameter of the optical intensity modulator is chosen to increase immunity of the effective modal bandwidth of the optical fiber to changes in temperature of at least one of the optical source and the optical fiber.

However, Ibe teaches the system wherein the temperature of an optical source (301 in fig. 13) is controlled (308 in fig. 13) by signal output by intensity modulator (303 in fig. 13) (page 8 para 0097).

It is desirable to control the wavelength output by a light source as it allows to minimize wavelength drift and allows to suppress signal degradation due to cross-phase modulation, which in turn eliminates the need for an optical modulator to have a large bandwidth.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply a method of controlling the wavelength output by a light source as taught by Ibe into the system of Fukuchi in order to minimize wavelength drift and to allow suppression of signal degradation due to cross-phase

modulation, which in turn eliminates the need for an optical modulator to have a large bandwidth.

13. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cunningham (US 6 064 786) in view of Fukuchi (US 5 745 613) and further in view of Chraplyvy (US 5 420 868).

With respect to Claim 25, Cunningham and Fukuchi disclose all the subject matter as recited in claim 20, but fail to teach an optical isolator that substantially eliminates reflected optical signals from propagating into the output of the optical intensity modulator.

However, Chraplyvy teaches an optical isolator (14 in fig. 1) that substantially eliminates reflected optical signals from propagating into the output of the optical intensity modulator (col. 3 lines 40-44).

It is beneficial to use optical isolator because it improves strength of the signal output of a laser due to minimized noise, occurring in the laser in presence of back reflections.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to employ optical isolator as taught by Chraplyvy into the system of Cunningham and Fukuchi as to improve laser signal strength.

14. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cunningham (US 6 064 786) in view of Fukuchi (US 5 745 613) and further in view of Ibe (US 2003/0058519)

With respect to Claim 26, Cunningham and Fukuchi disclose all the subject matter as recited in claim 20, but fail to teach that at least one parameter of the optical intensity modulator is chosen to increase immunity of the effective modal bandwidth of the optical fiber to changes in temperature of at least one of the optical source and the optical fiber.

However, Ibe teaches the system wherein the temperature of an optical source (301 in fig. 13) is controlled (308 in fig. 13) by signal output by intensity modulator (303 in fig. 13) (page 8 para 0097).

It is desirable to control the wavelength output by a light source as it allows to minimize wavelength drift and allows to suppress signal degradation due to cross-phase modulation, which in turn eliminates the need for an optical modulator to have a large bandwidth.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply a method of controlling the wavelength output by a light source as taught by Ibe into the system of Cunningham and Fukuchi in order to minimize wavelength drift and to allow suppression of signal degradation due to cross-phase modulation, which in turn eliminates the need for an optical modulator to have a large bandwidth.

15. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cunningham (US 6 064 786) in view of Fukuchi (US 5 745 613) and further in view of Asawa (US 6 185 346 - see IDS dated 20 Nov 2003).

With respect to Claim 28, Fukuchi and Cunningham disclose all the subject matter as recited in claim 20, but fail to teach a second spatial mode filter having an input that is coupled to an output of the multi-mode optical fiber, wherein the second spatial mode filter further increases the effective modal bandwidth of the multi-mode optical fiber.

However, Asawa teaches the system employing two connectors (108, 110 and 118, 120 in fig. 2) for connecting a single mode fiber (104 in fig. 2) to a multimode fiber (112 in fig. 2) and for connecting a multimode fiber (112 in fig. 2) to multimode fiber (122 in fig. 2) (col. 6 lines 56-63).

It is beneficial to employ spatial mode filtering after propagating optical signal through the multi-mode optical fiber as it allows to reduce modal dispersion of the multi-mode optical fiber, which leads to increase in the transmission bandwidth.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to employ second spatial mode filter as taught by Asawa into system of Cunningham and Fukuchi as to reduce modal dispersion of the multi-mode optical fiber, and to increase the transmission bandwidth.

16. Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cunningham (US 6 064 786) in view of Fukuchi (US 5 745 613) and further in view of Dai (US 2003/0011847 – see IDS dated 20 Nov 2003).

With respect to Claim 30, Cunningham and Fukuchi disclose all the subject matter as recited in Claims 20 and 29, but fail to teach an active filter that reconstructs dispersed optical signals received by the receiver using electronic dispersion compensation.

However, Dai teaches an active filter (fig. 2) that reconstructs dispersed optical signals received by the receiver using electronic dispersion compensation (page 4, para 0049 and 0052).

It is beneficial to compensate dispersion occurring when propagating a signal in an optical fiber as to minimize pulse distortion, and control the phase offset when a distorted signal is received.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to employ an active filter as taught by Asawa into system of Cunningham and Fukuchi as to minimize pulse distortion, and control the phase offset when a distorted signal is received.

17. Claim 34 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cunningham (US 6 064 786) in view of Fukuchi (US 5 745 613) and further in view of Kitajima (US 5 515 196).

With respect to claim 34, Cunningham and Fukuchi disclose the optical transmitter of claim 20, but fail to teach that at least one parameter of the optical intensity modulator comprises an absorption coefficient of the optical intensity modulator.

However, Kitajima teaches the system wherein at least one parameter of the optical intensity modulator comprises an absorption coefficient of the optical intensity modulator (col. 15 lines 53-59).

It is desirable to use an absorption coefficient of the optical intensity modulator as a control parameter because it allows to control the degree of the intensity modulation and because an absorption coefficient corresponds to propagation distance.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use an absorption coefficient of the optical intensity modulator as a control parameter as taught by Kitajima in order to achieve desired output characteristics by changing the degree of the intensity modulation in the system of Cunningham and Fukuchi.

18. Claim 39 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fukuchi (US 5 745 613) in view of Cunningham (US 6 064 786) and further in view of Chraplyvy (US 5 420 868).

With respect to Claim 39, Fukuchi and Cunningham disclose all the subject matter as recited in claim 35, but fail to teach an optical isolator that substantially

eliminates reflected optical signals from propagating into the output of the optical intensity modulator.

However, Chraplyvy teaches an optical isolator (14 in fig. 1) that substantially eliminates reflected optical signals from propagating into the output of the optical intensity modulator (col. 3 lines 40-44).

It is beneficial to use optical isolator because it improves strength of the signal output of a laser due to minimized noise, occurring in the laser in presence of back reflections.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to employ optical isolator as taught by Chraplyvy into the system of Fukuchi and Cunningham as to improve laser signal strength.

19. Claim 40 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fukuchi (US 5 745 613) in view of Cunnigham (US 6 064 786) and further in view of Tabuchi (JP 409318919).

With respect to Claim 40, Fukuchi and Cunningham disclose all the subject matter as recited in claim 1, but fail to teach that the at least one parameter of the optical intensity modulator is chosen to increase immunity of the effective modal bandwidth of the optical fiber to polarization effects occurring in at least one of the optical source and the optical fiber.

However, Tabuchi teaches the optical intensity modulator (20 in Figure) with polarization control (11 in Figure) to lower dependence on polarization (abstract).

It is beneficial to control polarization because it allows to minimize dispersion on a transmission link.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to include polarization control as taught by Tabuchi into the system of Fukuchi as to minimize dispersion on a transmission link.

20. Claim 41 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fukuchi (US 5 745 613) in view of Cunningham (US 6 064 786) and further in view of Ibe (US 2003/0058519)

With respect to Claim 41, Fukuchi and Cunningham disclose all the subject matter as recited in claim 35, but fail to teach that at least one parameter of the optical intensity modulator is chosen to increase immunity of the effective modal bandwidth of the optical fiber to changes in temperature of at least one of the optical source and the optical fiber.

However, Ibe teaches the system wherein the temperature of an optical source (301 in fig. 13) is controlled (308 in fig. 13) by signal output by intensity modulator (303 in fig. 13) (page 8 para 0097).

It is desirable to control the wavelength output by a light source as it allows to minimize wavelength drift and allows to suppress signal degradation due to cross-phase modulation, which in turn eliminates the need for an optical modulator to have a large bandwidth.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply a method of controlling the wavelength output by a light source as taught by Ibe into the system of Cunningham and Fukuchi in order to minimize wavelength drift and to allow suppression of signal degradation due to cross-phase modulation, which in turn eliminates the need for an optical modulator to have a large bandwidth.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

US 5 926 297 discloses optical modulating device

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Marina Taranina whose telephone number is (571) 270-1085. The examiner can normally be reached on Mon-Fri (alternative Fri off).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kenneth Vanderpuye can be reached on (571) 272-3078. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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MT
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